DOCUMENT RESUME

ED 108 614 IR 002 130

AUTHOR Dave, Ashok
TITLE Total Systems Considerations in Forming Alternative Configurations for a Computer-Based Instructional Management System.
INSTITUTION Southwest Regional Laboratory for Educational Research and Development, Los Alamitos, Calif.
REPORT NO SWRL-TN-5-72-13
PUB DATE 21 Mar 72
NOTE 9p.

EDRS PRICE MF-$0.76 HC-$1.58 PLUS POSTAGE
DESCRIPTORS *Computer Assisted Instruction; Computer Programs; Cost Effectiveness; Design Needs; Electronic Data Processing; Flexible Facilities; *Individualized Instruction; *Instructional Systems; *Management Systems; *Program Design; Reaction Time; Telecommunication; Time Factors (Learning)
IDENTIFIERS *Computer Software; IMS; Instructional Management System

ABSTRACT

Five considerations of a comprehensive configuration to carry out computer-based instructional management are described. Included are data communications networks, loading/distribution of data processing operations and Instructional Management System functions, response time, computer software, and flexibility. The need for such a configuration is explained. References are appended. (SK)

****
* Documents acquired by ERIC include many informal unpublished *
* materials not available from other sources. ERIC makes every effort *
* to obtain the best copy available. nevertheless, items of marginal *
* reproducibility are often encountered and this affects the quality *
* of the microfiche and hardcopy reproductions ERIC makes available *
* via the ERIC Document Reproduction Service (EDRS). EDRS is not *
* responsible for the quality of the original document. Reproductions *
* supplied by EDRS are the best that can be made from the original. *
****

ED108614

IR

SWRL

SOUTHWEST REGIONAL LABORATORY
TECHNICAL NOTE

DATE March 21, 1972

NO. TN 5-72-13

TITLE: TOTAL SYSTEMS CONSIDERATIONS IN FORMING ALTERNATIVE CONFIGURATIONS FOR A COMPUTER-BASED INSTRUCTIONAL MANAGEMENT SYSTEM

AUTHOR: Ashok Davé

ABSTRACT

Five considerations of a comprehensive configuration to carry out computer-based instructional management are briefly described. These include data communications networks, loading/distribution of data processing operations and IMS functions, response time, computer software, and flexibility.

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

IR 008 136

This document is intended for internal staff distribution and use. Permission to reprint or quote from this working document, wholly or in part, should be obtained from SWRL, 11300 La Cienega Boulevard, Inglewood, California, 90304.

TOTAL SYSTEMS CONSIDERATIONS IN FORMING ALTERNATIVE CONFIGURATIONS FOR A COMPUTER-BASED INSTRUCTIONAL MANAGEMENT SYSTEM

SWRL's Instructional Management System (IMS) is designed to collect individual performance data from schools, to process the data, and to provide useful derivative information to persons responsible for some aspect of the pupil's performance. IMS operational features and the alternative means of accomplishing these features are briefly identified in TM 5-72-02. Criteria, classified in three categories, were developed in TM 5-72-04 to provide a framework for the formation of alternative configurations. In addition to these a number of other considerations of a comprehensive system need to be clarified and understood. These considerations are briefly discussed in the following sections of this paper.

Data Communications

A lion's share of the capabilities and costs of most IMS configurations will be borne by the data communications network of the system. The system network must be able to satisfy user requirements in a cost-beneficial manner. Martin (1970), while discussing means of lowering communication network costs, points out that:

> If the lines are very long, they are expensive, so techniques for minimizing the cost of the lines needed dominate the network design. If the lines are short, their cost is of less concern, and the cost of the terminals and devices attached to the lines is of greater importance. Where the lines are very short, for example, all in one plant, one office block, or one campus, then their cost is of little significance in the design, and we often find their bandwidth being used quite wantonly. If a system has a large number of terminals, then the terminal cost becomes of major importance and the network organization should use schemes

> that enable the terminal design to be as inexpensive as possible... If the lines are more than 100 miles or so long, the line cost dominates the network design.

Naturally, a product (configuration) has to be ready, marketable, and attractive to the customer (user) before he can buy it. This problem can be solved by forming preliminary flexible configurations, determining their initial basic costs and capabilities, and then modifying a basic configuration as necessary to yield a maximally cost-effective system for each given user. Another approach could be to build a fairly large number of hypothetical user environments and form configurations to suit those environments. As before, when a special real-life user environment is identified, the configuration(s) most closely fulfilling the user requirements can be selected, modified, and presented as a package.

Loading/Distribution of Data Processing Operations

The next consideration is somewhat dependent on the previous one. An analysis should be inclusive of alternative ways of loading/distributing various data processing operations of a computer-based IMS. This can be exemplified by illustrating the SWRL IMS experimental configuration. It may pay off to carry out, for example, scoring and reporting at the PDP 8/I, leaving diagnosis, prescription and generation of instructional materials to the main computer.

A corollary stems from the fact that it may be desirable and cost-effective to have the scoring done by teachers at schools only (thereby eliminating unique input hardware, methods, and procedures), and the later functions, viz, reporting, diagnosis, prescription and generation

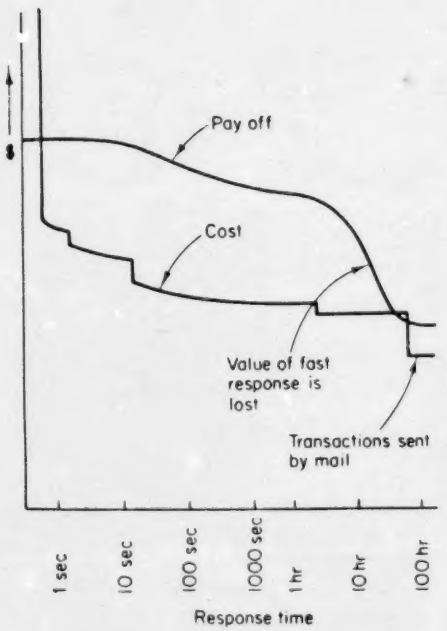
of instructional materials to be carried out by the computer. A potential user may want to utilize only Functions 1 and 2, and is therefore interested in a configuration only for these functions. Thus, there is an analytic requirement for configurations that can carry out any combinations of Function 1 with one, two, or all three of Functions 2, 3, 4.

Response Time

The third consideration concerns the need to determine cost of different response (turnaround) times, and their relative values to the potential users. A single configuration can be represented in terms of a range of costs and benefits on the basis of different turnaround time requirements. Response time requirements and their value for different IMS functions, reports, etc., must be known to form alternative configurations. Martin (1967) illustrates by the use of a simple cost-response time graph (see Fig. 1) how the cost of systems giving different response times may vary. The graph also depicts the variation of system value with the response time. In some applications, the value of having a fast, or real-time, response is considerably greater than that of a slow response. In other applications the payoff curve would be flatter, less dependent on response time. Martin (1967) further discusses a range of commonly found response-time requirements:

- Immediate (< 1 second)
- Conversational (< 15 seconds)
- As soon as it is convenient (within minutes)
- Deferred, on-line (< 1 hour)
- Within one day
- Long time available (weekly; mail mode)

Fig. 1. Cost-Response Time Relation



Note: The various functions carried out by one system often need different response times. These curves are likely, therefore, to be an oversimplification. Also, they are based on having a single, large computer doing data processing for commercial usage.

Various IMS outputs and queries may have response-time requirements at different places on such a range. From the system configuration perspective, a short response time may be as easy or, what is more important, as inexpensive to achieve as a longer one; sometimes not. Peak values of data traffic and their timings also play an important role for configuration formation.

Computer Software

The next consideration is related to the software aspects of the computer-based IMS configurations. It can be safely assumed that all of IMS applications programs, which have been written in Fortran, can be used on almost any machine with minor modifications. However, all the machine language programming carried out on SWRL's Data Concentrator, a Digital Equipment Corporation (DEC) PDP 8/I, will necessitate a major reprogramming effort by the potential users for their machine, if it is other than a DEC PDP 8/I. This would result in an increase in the total cost of such a configuration, which should be treated in comparing costs and effectiveness of alternative configurations.

Flexibility

The fifth consideration regards the flexibility and modularity of the configurations. As indicated in TM 5-72-02, computer costs may be expected to descend, while our ability to use them effectively may be expected to rise. What will be the implication of this trend on common school users? Even those users who are presently not much interested in IMS now may tend to be more attracted in the near future. Thus, the configurations formed at this stage, and in the future, must be sufficiently

flexible to accommodate and integrate future low-cost equipment. They should also have the capability to be expanded to carry out programs other than IMS, such as business and other student record applications. The need for a flexible configuration is evident from Cooley's (1970) conclusions with Individually Prescribed Instruction (IPI) at the Learning Research and Development Center (LRDC) at the University of Pittsburgh:

(1) The teacher and teacher aides in an IPI system can and will use computer assistance in recordkeeping and student monitoring function.

(2) The data-entry devices and student files must be much more flexible than the system of scan forms and fixed-format records which had been implemented. One objective of the IPI approach is a flexible system, but the lead time involved in printing scanner forms and in computer programming tended to produce inflexibility of operation.

(3) The data-retrieval system needs to be more accessible to the teacher. The demands for reports at the school became so great that we had to add a teletype to assist in report generation. This allowed data entry and report generation to go on simultaneously, but even this was not ultimately what the teachers wanted. We tried one teletype at a resource center next to a classroom, but it was rejected because it was too slow, too noisy, and too cumbersome for teacher use. The need in the classroom is for quiet devices which will allow the teacher to interact quickly and easily with the information required at the time a child is at her side, to review his record, and to plan future studies for him.

REFERENCES

Cooley, William W., "Computer Assistance for Individualized Education," Journal of Educational Data Processing, 7(1), 1970, p.21.

Martin, James, Design of Real-Time Computer Systems, Englewood Cliffs: Prentice-Hall, 1967, pp. 42-44.

Martin, James, Teleprocessing Network Organization, Englewood Cliffs: Prentice-Hall, 1970, pages 118, 127.